

Chapter 2

Experimental

2.1 Instruments and Chemicals

Infrared spectra were recorded using Jasco[®] IR-810 infrared spectrometer and major bands were reported in wave number (cm^{-1}). Ultraviolet (UV) absorption spectra were recorded using a Hewlett-Packard[®] 8452A diode array spectrophotometer and principle bands (λ_{max}) were reported as wavelength (nm) and $\log \epsilon$ in MeOH solution. Nuclear magnetic resonance spectra were recorded on 500 MHz Varian Unity Inova[®] spectrometer. ^1H and ^{13}C NMR spectra were recorded at 500 MHz and 125 MHz respectively in CDCl_3 using internal standard from the residual solvent signals at δ 7.26 and 77.0 in ^1H and ^{13}C NMR spectra, respectively. Optical rotation was measured from CHCl_3 solution with sodium D line (590 nm) on Jasco[®] DIP-370 digital polarimeter. Solvents for extraction and chromatography were distilled at their boiling point ranges prior to use. Column chromatography was performed on silica gel (Merck[®]) 60 (0.040-0.063 mm). Preparative TLC was performed on Merck[®] silica gel 60 GF₂₅₄ plates and the detection of compounds was accomplished by exposure to UV light at 254 nm and/or by spraying with ferric chloride-perchloric acid or Dragendorff's spraying reagents.

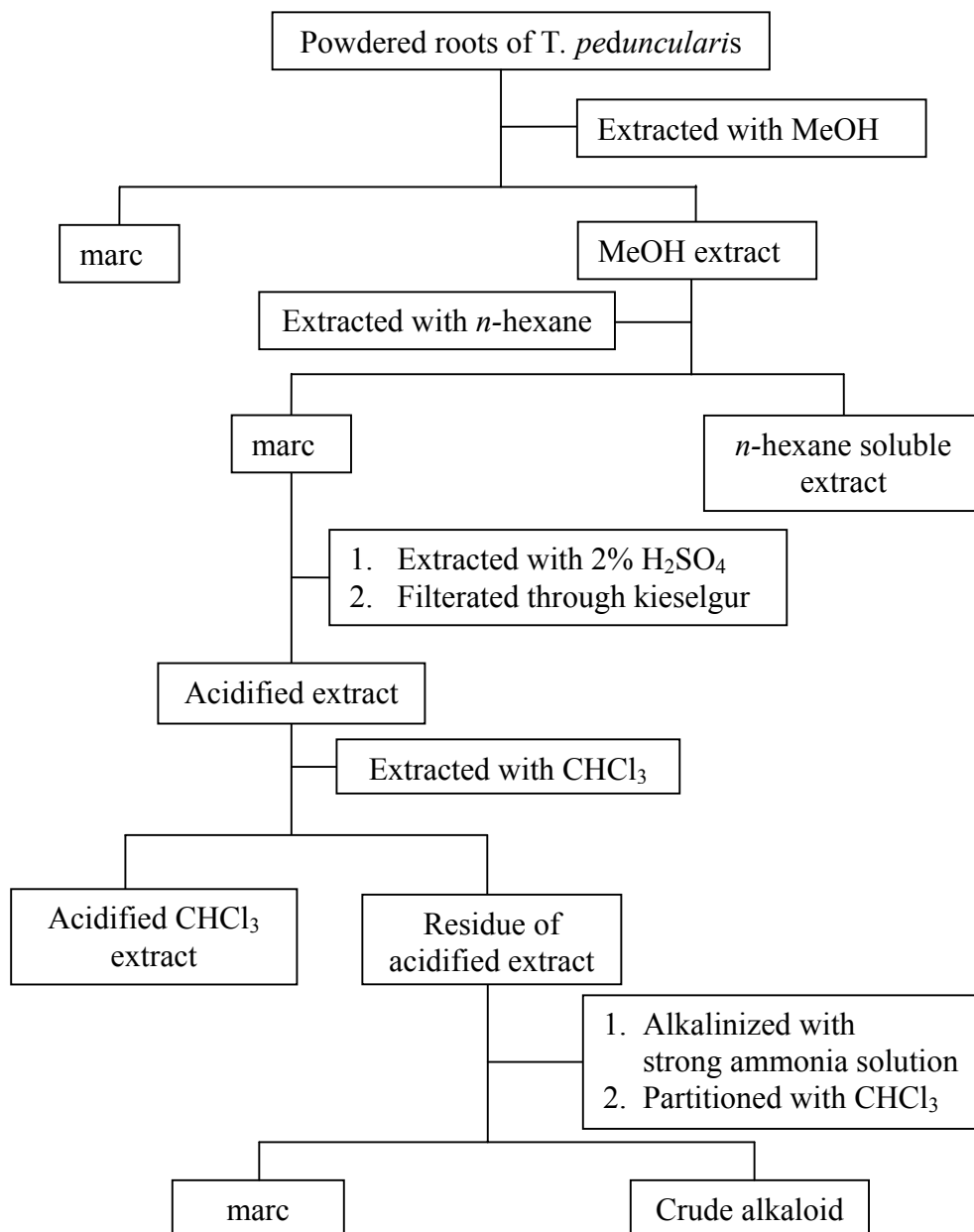
2.2 Plant material

Roots of *Tabernaemontana peduncularis* were collected in May 2002 from Krabi province, Thailand. The plants were identified by Associate Professor Dr. Sanan Subhadhirasakul and voucher specimens of plant materials (Specimen No. SN-12102001-03) has been deposited in the Department of Pharmacognosy and Pharmaceutical Botany, Faculty of Pharmaceutical Sciences, Prince of Songkla University, Hat Yai, Songkhla, Thailand.

2.3 Extraction

The dried, coarsely-powdered roots of *T. peduncularis* (2.8 kg) were macerated with methanol 8 L for three days and filtered; the filtrate was then evaporated under reduced pressure to give a syrupy mass. The marc was re-macerated with methanol (8 L) four times, filtered and evaporated as before. The evaporates were combined to give a methanol extract (250.56 g). The methanol extract was extracted with *n*-hexane (5 × 200 ml), filtered and evaporated as before to give a *n*-hexane soluble extract (24.76 g). Then, the residual methanol extract (185.95 g) was repeatedly re-extracted with 2% sulfuric acid (5 × 200 ml), filtered sequentially through kieselgur. The acidified extracts were combined and extracted with CHCl₃ (3 × 200 ml) then evaporated under reduced pressure to give an acidified CHCl₃ extract (4.435 g). The residual acidified extract was allowed to cool in an ice bath.

Scheme 2.1 Extraction of the crude alkaloid from the roots of *T. peduncularis*

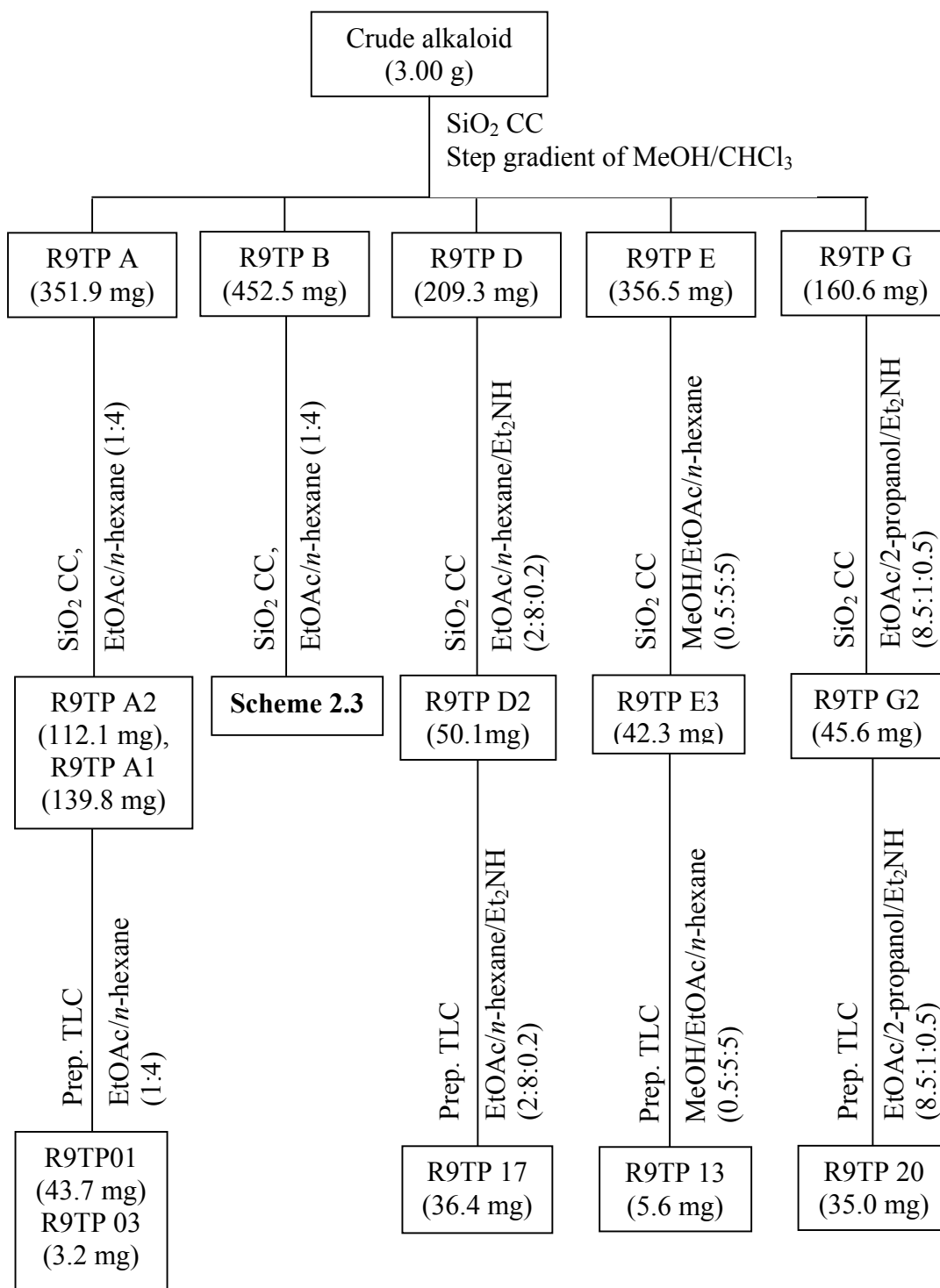


Then the cooled acidified extract was made basic (pH 9) with 25% NH_4OH and extracted with CHCl_3 (6×200 ml). The combined CHCl_3 extract was washed with water (2×500 ml), dried with anhydrous Na_2SO_4 and evaporated under reduced pressure to give the crude alkaloid (3.847 g). (The whole process are shown in **Scheme 2.1**)

2.4 Isolation and chemical investigation

2.4.1 Isolation of the crude alkaloid

The crude alkaloid (3.00 g) was separated by SiO_2 column chromatography. The column was eluted with a step gradient of MeOH in CHCl_3 , started with 3% MeOH in CHCl_3 and increased the proportion of MeOH to pure MeOH. Fractions of 75 ml were collected and combined by using the pattern on TLC. Twelve fractions were obtained, R9TP A to R9TP L. Fractions that showed positive reaction to ferric chloride-perchloric acid spraying reagent or Dragendroff's spraying reagent and visualized by UV light at 254 nm were selected for further separation.

Scheme 2.2 Isolation of the crude alkaloid from *T. peduncularis*

2.4.2 Isolation of the selected fractions

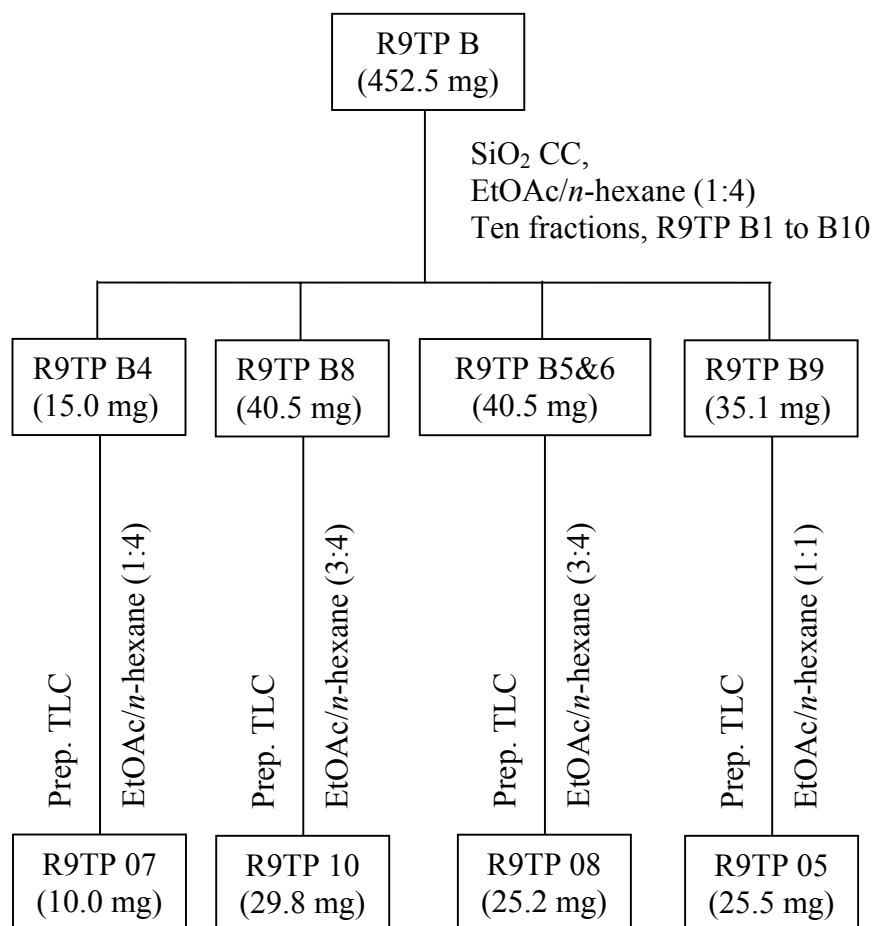
2.4.2.1 Isolation of R9TP A

R9TP A (351.9 mg) was separated by SiO₂ column chromatography using EtOAc/*n*-hexane (1:4) as eluting solvent. Ten fractions were obtained, R9TP A1 to R9TP A10. Furthermore, R9TP A1 (139.8 mg) was selected to submit on preparative TLC. EtOAc/*n*-hexane (1:4) was used as a mobile phase to afford a compound, R9TP 01 (43.7 mg, 1.46% of crude alkaloid). Likewise, R9TP A2 (112.1 mg) was further rechromatographed by the same procedure as fraction R9TP A1 and the other compound, R9TP 03 (3.2 mg, 0.11% of crude alkaloid) was obtained.

2.4.2.2 Isolation of R9TP B

Furthermore, R9TP B (452.5 mg) was rechromatographed on SiO₂ column chromatography using EtOAc/*n*-hexane (1:4) as an eluent. Ten fractions were obtained, R9TP B1 to R9TP B10 (As shown on **Scheme 2.3**). In addition, fraction R9TP B4 (15.0 mg) was further separated by preparative TLC using EtOAc/*n*-hexane (1:4) as a mobile phase. Therefore, R9TP 07 (10.0 mg, 0.33% of crude alkaloid) was obtained. Moreover, fractions R9TP B5 and B6 were combined (27.7 mg) and chromatographed on preparative TLC using EtOAc/*n*-hexane (3:4) as a mobile phase.

Scheme 2.3 Isolation of fraction R9TP B



The separation process gave R9TP 08 (25.2 mg, 0.84% of crude alkaloid). Likewise, R9TP B8 (40.5 mg) was further chromatographed on preparative TLC using EtOAc/*n*-hexane (3:4) as a mobile phase to afford R9TP 10 (29.8 mg, 0.99% of crude alkaloid). Similarly, fraction R9TP B9 (35.1 mg) was submitted on preparative TLC using EtOAc/*n*-hexane (1:1) as a mobile phase to afford R9TP 05 (25.5 mg, 0.85% of crude alkaloid).

R9TP 07 exhibited the same spectroscopic data as R9TP 03 while R9TP 05 and R9TP 10 also revealed the same spectroscopic data.

2.4.2.3 Isolation of R9TP D

In the same way, R9TP D (209.3 mg) was re-separated by SiO₂ column chromatography using EtOAc/*n*-hexane/Et₂NH (2:8:0.2) as eluting solvent. Five fractions were obtained R9TP D1 to R9TP D5. Then, R9TP D2 (50.1mg) was submitted on preparative TLC using EtOAc/*n*-hexane/Et₂NH (2:8:0.2) as a mobile phase to afford R9TP 17 (36.4 mg, 1.21% of crude alkaloid).

2.4.2.4 Isolation of R9TP E

R9TP E (356.5 mg) was further separated by SiO₂ column chromatography using MeOH/EtOAc/*n*-hexane (0.5:5:5) as eluting solvent. Seven fractions were obtained, R9TP E1 to R9TP E7. In addition, R9TP E3 (42.3 mg) was submitted on preparative TLC using MeOH/EtOAc/*n*-hexane (0.5:5:5) as a mobile phase to afford R9TP 13 (5.6 mg, 0.19% of crude alkaloid).

2.4.2.5 Isolation of R9TP G

Furthermore, R9TP G (160.6 mg) was re-separated by SiO₂ column chromatography. The column was eluted by EtOAc/2-propanol/Et₂NH (8.5:1:0.5). Thus, five fractions were obtained, R9TP G1 to R9TP G5. Finally, R9TP G2 (45.6 mg) was submitted on preparative TLC using EtOAc/2-propanol/Et₂NH (8.5:1:0.5) as a mobile phase to afford R9TP 20 (35.0 mg, 1.17% of crude alkaloid).

2.5 Spectral data of isolated compound

2.5.1 Compound R9TP 01

$[\alpha]_D$	-35.7° (<i>c</i> 0.28, CHCl ₃)
UV (MeOH) λ_{\max} nm (log ϵ)	226 (5.50), 286 (4.91)
IR (Thin film) ν (cm ⁻¹)	3375, 2925, 2850, 1710, 1460, 1250, 740
EIMS m/z (% relative intensity)	338[M] ⁺ (100%), 323 (23%), 309 (6%), 214 (17%), 136 (57%), 124 (26%), 122 (17%)
¹ H NMR (δ)	7.81 (br s, 1H), 7.48 (br dd, J = 8.1, 1.2 Hz, 1H), 7.24 (br dd, J = 8.1, 1.2 Hz, 1H), 7.14 (ddd, J = 8.1, 7.1, 1.2 Hz, 1H), 7.08 (ddd, J = 8.1, 7.1, 1.2 Hz, 1H), 3.71 (s, 3H), 3.56 (br s, 1H), 3.39 (ddd, J = 13.5, 7.8, 4.2 Hz, 1H), 3.22 (ddd, J = 13.5, 7.3, 6.1 Hz, 1H), 3.18 (ddd, J = 16.1, 7.8, 6.1 Hz, 1H), 3.01 (ddd, J = 16.1, 7.3, 4.2 Hz, 1H), 2.91 (br ddd, J = 8.5, 2.0, 2.0 Hz, 1H), 2.81 (br ddd, J = 8.5, 2.0, 2.0 Hz, 1H), 2.58 (ddd, J = 12.0, 2.4, 2.4 Hz, 1H), 1.90 (ddd, J = 12.0, 4.2, 2.0 Hz, 1H), 1.88 (m, 1H), 1.74 (dddd, J = 12.7, 9.8, 4.1, 1.9 Hz, 1H), 1.57 (ddq, J = 13.4, 7.6, 7.3 Hz, 1H), 1.44 (ddq, J = 13.4, 7.6, 7.1 Hz, 1H), 1.33 (br dddd, J = 9.5, 7.3,

7.3, 7.1 Hz, 1H), 1.13 (dddd, $J= 12.7, 7.3, 2.0, 1.9$ Hz, 1H), 0.90 (t, $J= 7.6$ Hz, 3H)

^{13}C NMR (δ) 175.74, 136.53, 135.40, 128.77, 121.91, 119.20, 118.42, 110.32, 110.27, 57.47, 55.05, 53.09, 52.57, 51.50, 39.12, 36.47, 32.00, 27.32, 26.70, 22.07, 11.64

2.5.2 Compound R9TP 03

$[\alpha]_{\text{D}}$ +16.0° (c 0.10, CHCl_3)

UV (MeOH) λ_{max} nm (log ϵ) 224 (4.17), 250 (3.56), 280 (3.46), 286 (3.47)

IR (Thin film) ν (cm^{-1}) 3450, 2950, 2850, 1735, 1460, 1240, 750

EIMS m/z 354[M]⁺ (89%), 337 (98%), 295 (14%), 253 (4%),
(% relative intensity) 230 (9%), 160 (18%), 122 (16%)

^1H NMR (δ) 7.47 (br dd, $J= 7.6, 1.2$ Hz, 1H), 7.35 (br ddd, $J= 7.3, 1.2, 0.7$ Hz, 1H), 7.32 (ddd, $J= 7.6, 7.6, 1.2$ Hz, 1H), 7.23 (ddd, $J= 7.6, 7.3, 1.0$ Hz, 1H), 3.81 (br s, 1H), 3.71 (s, 3 H), 3.51 (ddd, $J= 14.9, 3.2, 2.2$ Hz, 1H), 2.97 (ddd, $J= 14.9, 4.6, 1.7$ Hz, 1H), 2.75 (m, 2 H), 2.75 (m, 1H), 2.49 (ddd, $J= 14.1, 4.6, 2.2$ Hz, 1H), 2.01 (ddd, $J= 14.9, 3.2, 1.7$ Hz, 1H), 1.93 (m, 1H), 1.88

(ddd, $J= 14.9, 4.6, 2.2$ Hz, 1H), 1.78 (dddd, $J= 12.7, 9.3, 4.6, 1.2$ Hz, 1H), 1.47 (m, 1H), 1.43 (m, 1H), 1.41 (m, 1H), 1.10 (dddd, $J= 12.7, 7.1, 2.2, 2.2$ Hz, 1H), 0.87 (t, $J= 7.3$ Hz, 3 H)

^{13}C NMR (δ) 189.25, 173.72, 151.29, 142.64, 129.18, 126.79, 121.43, 120.84, 88.35, 58.72, 58.42, 53.24, 49.05, 48.69, 37.54, 34.73, 33.83, 32.01, 26.98, 26.50, 11.55

2.5.3 Compound R9TP 05

$[\alpha]_{\text{D}}$ -17.1° (c 0.18, CHCl_3)

UV (MeOH) λ_{max} nm ($\log \epsilon$) 226 (4.53), 256 (3.52), 286 (3.93)

IR (Thin film) ν (cm^{-1}) 3375, 3250, 2940, 2860, 1720, 1460, 1430, 1250, 750

EIMS m/z 354 $[\text{M}]^+$ (100%), 336 (72%), 309 (18%), 214 (38%), 195 (17%), 168 (20%), 154 (27%), 152 (37%), 130 (19%), 122 (15%)

^1H NMR (δ) 7.93 (br s, 1H), 7.49 (br dd, $J= 7.1, 1.1$ Hz, 1H), 7.27 (br dd, $J= 7.1, 0.9$ Hz, 1H), 7.18 (ddd, $J= 8.0,$

7.1, 1.1 Hz, 1H), 7.11 (ddd, $J= 8.0, 7.1, 0.9$ Hz, 1H), 4.17 (dq, $J= 12.6, 6.4$ Hz, 1H), 3.86 (br s, 1H), 3.74 (s, 3H), 3.46 (ddd, $J= 15.1, 7.3, 2.7$ Hz, 1H), 3.15 (ddd, $J= 15.1, 5.7, 2.3$ Hz, 1H), 3.10 (ddd, $J= 15.1, 7.3, 2.3$ Hz, 1H), 3.05 (ddd, $J= 15.1, 5.7, 2.7$ Hz, 1H), 2.99 (ddd, $J= 9.2, 3.7, 2.5$ Hz, 1H), 2.81 (br dd, $J= 9.2, 2.1$ Hz, 1H), 2.61 (ddd, $J= 13.5, 2.1, 2.1$ Hz, 1H), 2.03 (m, 1H), 1.98 (ddd, $J= 13.5, 4.1, 2.5$ Hz, 1H), 1.91 (dddd, $J= 12.8, 7.1, 2.5, 2.3$ Hz, 1H), 1.56 (dddd, $J= 12.8, 10.8, 4.1, 2.1$ Hz, 1H), 1.47 (dddd, $J= 12.6, 10.8, 7.1, 1.1$ Hz, 1H), 1.1 (d, $J= 6.4$ Hz, 3H)

^{13}C NMR (δ) 174.90, 135.70, 135.47, 128.43, 122.24, 119.42, 118.41, 110.45, 109.76, 71.33, 59.76, 54.02, 52.96, 52.16, 51.12, 39.45, 36.92, 26.98, 22.87, 21.43, 20.32

2.5.4 Compound R9TP 08

$[\alpha]_{\text{D}}$ -52.0° (c 0.10, CHCl_3)

UV (MeOH) λ_{max} nm (log ϵ) 226 (4.56), 254(3.48), 286(3.82)

IR (Thin film) ν (cm^{-1})	3450, 3375, 2950, 2860, 1720, 1460, 1260, 740
HRFAB MS m/z	$[\text{M}+\text{H}]^+$ 369.2168 $\text{C}_{22}\text{H}_{29}\text{N}_2\text{O}_3$ (calculated for $\text{C}_{22}\text{H}_{29}\text{N}_2\text{O}_3$, 369.2178).
EIMS m/z (% relative intensity)	368 $[\text{M}]^+$ (17%), 338 (22%), 337 (89%), 281 (10%), 228 (5%), 221 (15%), 207 (14%), 122 (10%)
^1H NMR (δ)	7.61 (br s, 1H), 7.41(br dd, $J= 8.0, 1.2$ Hz, 1H), 7.26 (br dd, $J=8.1, 1.1$ Hz, 1H), 7.16 (ddd, $J= 8.0, 7.1, 1.1$ Hz, 1H), 7.10 (ddd, $J= 8.1, 7.1, 1.2$ Hz, 1H), 3.71 (br s, 3H), 3.64 (dd, $J=10.9, 2.6$ Hz, 1H), 3.54 (br dd, $J=$ 10.9 7.0 Hz, 1H), 3.27 (s, 1H), 3.36 (ddd, $J= 13.9,$ 7.6, 6.2 Hz, 1H), 3.28 (ddd, $J= 13.9, 10.0, 6.0$ Hz, 1H), 3.15 (ddd, $J= 15.9, 10.0, 6.2$ Hz, 1H), 3.09 (ddd, $J= 15.9, 7.6, 6.0$ Hz, 1H), 2.92 (br dd, $J= 7.0, 2.6$ Hz, 1H), 2.65 (dd, $J= 13.5, 1.8$ Hz, 1H), 2.00 (ddd, $J=$ 13.5, 4.1, 1.5 Hz, 1H), 1.92 (m, 1H), 1.59 (ddq, $J=$ 13.7, 7.4, 6.1 Hz, 1H), 1.59 (ddd, $J= 16.2, 7.4, 4.6$ Hz, 1H), 1.47 (dddd, $J= 16.2, 7.4, 2.2, 1.5$ Hz, 1H), 1.44 (ddq, $J= 13.7, 7.4, 7.2$ Hz, 1H), 1.32 (br dddd, $J= 7.4, 7.4, 7.2, 6.1$ Hz, 1H), 0.92 (dd, $J= 7.4, 7.4$ Hz, 3H)

^{13}C NMR (δ)	175.44, 136.30, 135.50, 128.47, 122.05, 119.29, 118.34, 110.40, 109.95, 62.22, 59.92, 57.92, 54.96, 52.67, 51.57, 38.28, 38.11, 30.75, 27.56, 26.44, 21.76, 11.69
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2.5.5 Compound R9TP 13

$[\alpha]_{\text{D}}$	-78.0° (<i>c</i> 0.13, CHCl_3).
UV (MeOH) λ_{max} nm (log ϵ)	388 (3.27), 260 (3.62), 230 (4.41)
IR (Thin film) ν (cm^{-1})	3350, 2925, 2850, 1720, 1620, 1200, 750
EIMS m/z (% relative intensity)	354 $[\text{M}]^+$ (100%), 339 (4%), 295 (46%), 209 (11%), 84 (10%), 156 (12%), 150 (195%), 138 (45%), 122 (44%), 109 (73%)
^1H NMR (δ)	7.57 (br dd, $J= 7.7, 1.3$ Hz, 1H), 7.39 (ddd, $J= 8.2,$ 7.1, 1.3 Hz, 1H), 7.27 (br dd, $J= 8.2, 0.7$ Hz, 1H), 6.81 (br ddd, $J= 7.7, 7.1, 0.7$ Hz, 1H), 4.5 (br s, 1H), 3.93 (br s, 1H), 3.86 (dd, $J= 14.2, 3.4$ Hz, 1H), 3.27 (s, 3H), 3.06 (dd, $J= 12.4, 1.8$ Hz, 1H), 2.77 (dd, $J=$ 14.2, 4.4 Hz, 1H), 2.63 (m, 1H), 2.63 (m, 1H), 2.10 (ddd, $J= 4.4, 3.4, 3.4$ Hz, 1H), 1.64 (dd, $J= 11.8, 2.2$ Hz,

1H), 1.64 (br dd, $J = 13.8, 2.2$ Hz, 1H), 1.56 (dddd, $J = 13.2, 10.7, 2.7, 2.7$ Hz, 1H), 1.50 (m, 1H), 1.46 (ddq, $J = 13.4, 7.4, 7.4$ Hz, 1H), 1.33 (br dddd, $J = 10.7, 7.4, 7.4, 7.1$ Hz, 1H), 1.25 (m, 1H), 1.09 (dddd, $J = 13.2, 7.1, 3.4, 3.4$ Hz, 1H), 0.91 (t, $J = 7.4$ Hz, 3H)

^{13}C NMR (δ) 174.20, 158.41, 136.59, 124.28, 121.24, 119.27, 112.14, 65.88, 51.91, 51.64, 51.08, 50.65, 47.88, 35.77, 31.00, 30.66, 28.58, 26.02, 25.52 and 11.99

2.5.6 Compound R9TP 17

$[\alpha]_{\text{D}}$ +3.4° (c 0.19, CHCl_3)

UV (MeOH) λ_{max} nm ($\log \epsilon$) 224 (4.68), 254 (3.58), 282 (4.01)

IR (Thin film) ν (cm^{-1}) 3400, 3200, 2940, 2855, 1460, 760

FABMS m/z 281[M+H] $^+$ (100%), 277 (4%)

(% relative intensity)

^1H NMR (δ) 7.61 (br s, 1H), 7.46 (br dd, $J = 7.1, 1.2$ Hz, 1H), 7.23 (br ddd, $J = 7.1, 1.3, 0.6$ Hz, 1H), 7.11 (ddd, $J = 7.1, 7.1, 1.2$ Hz, 1H), 7.08 (ddd, $J = 7.1, 7.1, 1.3$ Hz, 1H), 3.38 (ddd, $J = 16.1, 4.6, 2.2$ Hz, 1H), 3.34

(ddd, $J= 16.5, 3.8, 2.2$ Hz, 1H), 3.14 (ddd, $J= 16.1, 3.8, 2.3$ Hz, 1H), 3.06 (ddd, $J= 9.3, 2.3, 2.3$ Hz, 1H), 2.98 (ddd, $J= 9.3, 2.6, 2.6$ Hz, 1H), 2.89 (ddd, $J= 11.6, 6.0, 1.8$ Hz, 1H), 2.85 (br s, 1H), 2.67 (ddd, $J= 16.5, 4.6, 2.3$ Hz, 1H), 2.02 (dddd, $J= 15.7, 11.6, 2.6, 2.6$ Hz, 1H), 1.84 (m, 1H), 1.81 (dddd, $J= 15.1, 10.5, 2.3, 2.3$ Hz, 1H), 1.63 (dddd, $J= 15.7, 6.0, 3.2, 3.2$ Hz, 1H), 1.56 (ddq, $J= 15.4, 7.2, 7.2$ Hz, 1H), 1.55 (br dddd, $J= 10.5, 10.0, 7.3, 7.2$ Hz, 1H), 1.47 (ddq, $J= 15.4, 7.3, 7.2$ Hz, 1H), 1.22 (dddd, $J= 15.1, 10.0, 3.2, 3.2$ Hz, 1H), 0.90 (t, $J= 7.2$ Hz, 3H)

^{13}C NMR (δ) 141.70, 134.59, 129.62, 120.91, 119.06, 117.86, 110.08, 109.08, 57.60, 54.15, 49.86, 41.87, 41.27, 34.08, 32.00, 27.73, 26.38, 20.55, 11.90

2.5.7 Compound R9TP 20

$[\alpha]_{\text{D}}$ -34.3° (c 0.14, CHCl_3)

UV (MeOH) λ_{max} nm (log \mathcal{E}) 224 (4.60), 252 (3.44), 286 (3.93)

IR (Thin film) ν (cm^{-1})	3250, 2950, 2860, 1735, 1650, 1460, 1250, 750
FABMS m/z	353[M+H] ⁺ (100%), 293 (10%), 185 (4%), 144
(% relative intensity)	(5%)
¹ H NMR (δ)	8.17 (br s, 1H), 7.48 (br dd, $J = 7.1, 1.1$ Hz, 1H), 7.23 (br dd, $J = 7.1, 1.0$ Hz, 1H), 7.13 (ddd, $J = 8.1,$ 7.1, 1.1 Hz, 1H), 7.08 (ddd, $J = 8.1, 7.1, 1.0$ Hz, 1H), 4.51 (br s, 1H), 4.48 (ddd, $J = 14.9, 9.6, 3.2$ Hz, 1H), 3.71 (s, 3H), 3.22 (ddd, $J = 14.9, 6.5, 1.6$ Hz, 1H), 3.21 (ddd, $J = 14.8, 9.6, 1.6$ Hz, 1H), 3.19 (ddd, $J = 14.9, 6.5, 3.2$ Hz, 1H), 2.64 (dd, $J = 13.5,$ 1.7 Hz, 1H), 2.61 (m, 1H), 2.30 (ddd, $J = 13.5, 4.1,$ 1.7 Hz, 1H), 1.99 (ddd, $J = 13.3, 10.0, 3.3$ Hz, 1H), 1.74 (br dddd, $J = 11.1, 10.0, 7.4, 7.2$ Hz, 1H), 1.53 (ddq, $J = 14.6, 7.3, 7.2$ Hz, 1H), 1.44 (ddq, $J = 14.6,$ 7.4, 7.3 Hz, 1H), 1.41 (dddd, $J = 13.3, 11.1, 5.1, 2.7$ Hz, 1H), 0.98 (t, $J = 7.3$ Hz, 3H)
¹³ C NMR (δ)	175.75, 173.00, 135.66, 133.86, 127.75, 122.28, 119.51, 118.30, 110.56, 109.27, 56.06, 55.50, 52.95, 42.65, 38.12, 35.80, 35.40, 30.93, 27.57, 21.00, 11.32